

# PATENT ABSTRACTS OF JAPAN

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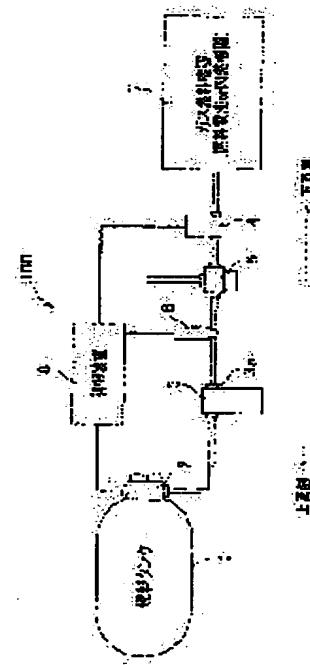
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## (54) METHOD FOR STOPPING AND STARTING GAS FUEL SUPPLYING APPARATUS, AND THE GAS FUEL SUPPLYING APPARATUS

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a gas fuel supplying apparatus for safely stopping gas fuel equipment even after pressure in a decompressor becomes abnormal shutting itself off, and for easily restarting the gas fuel equipment when the function of the decompressor is restored.

**SOLUTION:** The gas fuel supplying apparatus 100 for supplying a high-pressure gas fuel to an internal combustion engine or gas fuel equipment 7 such as a fuel cell via the decompressor 3 comprises: a pressure sensor 6 at a decompression chamber side 3a in the decompressor 3; cutoff valves 2, 4 at the upstream and downstream sides of the decompressor 3. When pressure at the decompression chamber side 3a in the decompressor 3 becomes a specific pressure or more, the two cutoff valves 2, 4 are simultaneously broken, the cutoff valve 4 at the downstream of the decompressor 3 is opened first when the gas fuel equipment 7 is restarted, and the cutoff valve 2 at the upstream of the decompressor 3 is opened later when the pressure in the decompression chamber side 3a is less than a prescribed pressure.



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**CLAIMS**

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[Claim(s)]

[Claim 1]

It is a stop of a fuel gas feed unit and a start method of supplying fuel gas to fuel gas apparatus, When a pressure of the downstream of a pressure reducer which decompresses fuel gas is more than a predetermined pressure, a cutoff valve of the upper stream of said pressure reducer and the lower stream is intercepted, and supply of fuel gas to said fuel gas apparatus is suspended, At the time of a reboot of said fuel gas apparatus, said cutoff valve of the lower stream of said pressure reducer is opened wide, and supply of fuel gas to said fuel gas apparatus is started, A stop and a start method of a fuel gas feed unit opening said cutoff valve of the upper stream of said pressure reducer wide, and starting supply of fuel gas to said fuel gas apparatus when a pressure of the downstream of said pressure reducer falls to less than a predetermined pressure.

[Claim 2]

A pressure reducer which decompresses fuel gas, and a cutoff valve of the upstream arranged at the upstream of said pressure reducer, It is a fuel gas feed unit including a pressure sensor which detects a pressure between a cutoff valve of the downstream arranged at the downstream of said pressure reducer, and said pressure reducer and a cutoff valve of said downstream, and a control means which directs interception and opening of a cutoff valve of said upstream, and a cutoff valve of said downstream,

Said control means,

A fuel gas feed unit which will be characterized by carrying out the open directions of the cutoff valve of said upstream if a pressure which will carry out the open directions of the cutoff valve of said downstream, and will be detected by said pressure sensor if a seizing signal is inputted becomes below predetermined pressure.

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**TECHNICAL FIELD****[Field of the Invention]**

This invention relates to the stop of a fuel gas feed unit and the start method of decompressing high pressure gas with a pressure reducer, and supplying to fuel gas apparatus, such as an internal-combustion engine or a fuel cell, as fuel gas, and relates to the stop of a fuel gas feed unit and the start method at the time of the pressure abnormality of a pressure reducer especially.

[0002]

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**PRIOR ART****[Description of the Prior Art]**

It is what intercepts fuel gas in the fuel piping system which supplies fuel gas to fuel gas apparatus which used high pressure gas as fuel conventionally, such as an internal-combustion engine and a fuel cell, at the time of the abnormalities of a pressure. The decompression chamber side of the pressure reducer which decompresses high pressure gas is equipped with the pressure sensor which detects the pressure of a decompression chamber, and when it detects that the pressure in a decompression chamber became more than the predetermined pressure, there is a fuel gas feed unit controlled to close the cutoff valve which is upstream of a pressure reducer.

**[0003]**

Although the safety valve which it had downstream from the decompression chamber operates and the inside of a decompression chamber is decompressed, also when a safety valve breaks down, the safeguard of the pressure reducer for fuel gas which intercepts the passage of high pressure gas by the cutoff valve of fuel is known (for example, refer to patent documents 1). When a defect occurs in the pressure regulation mechanism of a pressure reducer by a certain cause and the pressure in a decompression chamber becomes more than a predetermined pressure, this detects this with a pressure sensor and is intercepting the passage of high pressure gas by driving the cutoff valve of fuel. Impression of the high pressure gas to a low-pressure-pipes system can be prevented beforehand by this, and breakage of low-pressure-pipes parts can be avoided. When the safety valve is provided, the safety valve operates first, and the inside of a decompression chamber is decompressed, but also when a safety valve breaks down, the abnormal pressure in a decompression chamber is detected with a pressure sensor, and the passage of high pressure gas is intercepted by the fuel emergency trip valve.

**[0004]****[Patent documents 1]**

JP,63-41651,A (the 8th page, Drawing 2)

**[0005]**

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**EFFECT OF THE INVENTION****[Effect of the Invention]**

It detects as poor [ become / the pressure of the downstream of a pressure reducer / more than a predetermined pressure ] in a pressure reducer according to the invention according to claim 1, as explained above. Since two cutoff valves provided in the upper stream and the lower stream of the pressure reducer which decompress fuel gas are intercepted simultaneously, the fuel gas apparatus connected with the cutoff valve of the lower stream of a pressure reducer can be suspended safely.

[0029]

At the time of the reboot of fuel gas apparatus, such as an internal-combustion engine or a fuel cell. When the cutoff valve of the lower stream of a pressure reducer is opened previously, supply of fuel gas is started to fuel gas apparatus and the pressure of the downstream of a pressure reducer becomes in less than a predetermined pressure, in order to open the cutoff valve of the upper stream of a pressure reducer behind. The pressure sensor can check that the pressure in a decompression chamber is less than a predetermined pressure, and can reboot fuel gas apparatus easily. When the fault of a pressure reducer is solved, operation of fuel gas apparatus can be resumed.

[0030]

According to the invention according to claim 2, when the function of a pressure reducer is recovered after the pressure of the pressure reducer having become unusual and stopping, fuel gas apparatus can be rebooted easily.

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**TECHNICAL PROBLEM****[Problem(s) to be Solved by the Invention]**

By the way, in the case where intercept not only the cutoff valve of the upper stream of a pressure reducer but a downstream cutoff valve, and the whole system of fuel gas apparatus is stopped at the time of the fault of the pressure in a decompression chamber, etc., Since the pressure more than a predetermined pressure was confined in the decompression chamber side, even when the function of a pressure reducer was recovered, the reboot of fuel gas apparatus might not be completed. That is, for the pressure confined in the decompression chamber side, the pressure sensor detected the pressure reducer as poor, and there was a problem that fuel gas apparatus could not be rebooted.

**[0006]**

If setting out of the pressure which closes the cutoff valve of the upper stream of a pressure reducer is set up more highly than the injection-valve opening pressure of a safety valve when a safety valve is provided in the decompression chamber side of a pressure reducer, Even when were set up low for the pressure by the side of a decompression chamber to be unable to detect the very small pressure fluctuation which changes near the injection-valve-opening-pressure power of a safety valve at the time of the fault of a pressure reducer, and have described above, and it changed into the state where the pressure more than a setting pressure was confined in the decompression chamber side and the function of a pressure reducer was recovered, there was a problem that a reboot was impossible.

**[0007]**

This invention is made in order to solve said technical problem, and it is a thing. The purpose is to provide the stop of a fuel gas feed unit and the start method of rebooting fuel gas apparatus easily, when the function of a pressure reducer is recovered after \*\* became unusual and stopped.

**[0008]**

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**MEANS****[Means for Solving the Problem]**

The invention according to claim 1 of this inventions which solved said technical problem, When a pressure of the downstream of a pressure reducer which is a stop of a fuel gas feed unit and a start method of supplying fuel gas to fuel gas apparatus, and decompresses fuel gas is more than a predetermined pressure, Intercept a cutoff valve of the upper stream of said pressure reducer, and the lower stream, stop, and supply of fuel gas to said fuel gas apparatus at the time of a reboot of said fuel gas apparatus. When said cutoff valve of the lower stream of said pressure reducer is opened wide, supply of fuel gas to said fuel gas apparatus is started and a pressure of the downstream of said pressure reducer falls to less than a predetermined pressure, said cutoff valve of the upper stream of said pressure reducer is opened wide, and supply of fuel gas to said fuel gas apparatus is started.

[0009]

In order that a pressure of the downstream of said pressure reducer may intercept simultaneously two cutoff valves provided in the upper stream and the lower stream of a pressure reducer which detect as poor [ become / more than a predetermined pressure ] in a pressure reducer, and decompress said fuel gas according to the invention according to claim 1, Fuel gas apparatus connected with a cutoff valve of the lower stream of a pressure reducer can be suspended safely.

[0010]

At the time of a reboot of fuel gas apparatus, such as an internal-combustion engine or a fuel cell. When a cutoff valve of the lower stream of a pressure reducer is opened previously, supply of fuel gas is started to fuel gas apparatus and a pressure of the downstream of a pressure reducer becomes in less than a predetermined pressure, in order to open a cutoff valve of the upper stream of a pressure reducer behind, The pressure sensor can check that a pressure in a decompression chamber is less than a predetermined pressure, and can reboot fuel gas apparatus easily. When fault of a pressure reducer is solved, operation of fuel gas apparatus can be resumed.

[0011]

A pressure reducer with which the invention according to claim 2 decompresses fuel gas, and a cutoff valve of the upstream arranged at the upstream of said pressure reducer, A pressure sensor which detects a pressure between a cutoff valve of the downstream arranged at the downstream of said pressure reducer, and said pressure reducer and a cutoff valve of said downstream, Are a control means which directs interception and opening of a cutoff valve of said upstream, and a cutoff valve of said downstream an included fuel gas feed unit, and said control means, If a pressure which will carry out the open directions of the cutoff valve of said downstream, and will be detected by said pressure sensor if a seizing signal is inputted becomes below predetermined pressure, the open directions of the cutoff valve of said upstream will be carried out.

[0012]

According to the invention according to claim 2, said control means, If a pressure which will carry out the open directions of the cutoff valve of said downstream, and will be detected by

• said pressure sensor if a seizing signal is inputted becomes below predetermined pressure, in order to carry out the open directions of the cutoff valve of said upstream, When a function of a pressure reducer is recovered after a pressure of a pressure reducer having become unusual and stopping, fuel gas apparatus can be rebooted easily.

[0013]

[Embodiment of the Invention]

The stop of a fuel gas feed unit and the start method concerning this invention are explained with reference to drawings. Drawing 1 is a schematic diagram showing the composition of the fuel gas feed unit 100 concerning one embodiment of this invention. In drawing 1, the fuel gas feed unit 100 is carried in the unillustrated fuel gas car. In this fuel gas feed unit 100, the pressure of the fuel tank 1 in which high pressure gas fuel is stored is decompressed by the desired pressure with the pressure reducer 3, and this decompressed fuel gas is supplied to the fuel gas apparatus 7, such as fuel \*\*\*\* or an internal-combustion engine. A stop and start of supply of fuel gas are performed by the cutoff valve 2 of the upper stream of the pressure reducer 3, and the downstream cutoff valve 4. The cutoff valve 2 of a besides style is a cutoff valve of the yne tank equipped in the fuel tank 1. The fuel gas apparatus 7 is connected to the downstream cutoff valve 4. Here, the fuel tank 1 in which high pressure gas fuel is stored is made into the upstream, and the fuel gas apparatus 7 is made into the downstream. Between the cutoff valves 4, it has the safety valve 5 the decompression chamber side 3a of the pressure reducer 3. The pressure sensor 6 is formed between the pressure reducer 3 and the safety valve 5, and the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 is detected. These cutoff valves 2 and 4 and pressure sensors 6 are connected to the control device 8 which controls the fuel gas feed unit 100. About the details of the function of a control device (control means), it clarifies with reference to a flow chart etc. later.

[0014]

Next, a stop of the fuel gas feed unit 100 and the start method provided with the above composition are explained. In the fuel gas feed unit 100 which supplies high pressure gas fuel to the fuel gas apparatus 7, such as an internal-combustion engine or a fuel cell, via the pressure reducer 3 as shown in drawing 1. If the upper stream and the lower stream of the pressure sensor 6 and the pressure reducer 3 which detect the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 are equipped with the cutoff valves 2 and 4 and the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 turns into more than a predetermined pressure, The cutoff valve 2 of the upper stream of the pressure reducer 3 and the downstream cutoff valve 4 are intercepted almost simultaneous, and supply of the fuel gas to the fuel gas apparatus 7 is suspended.

[0015]

In such a fuel piping system, since residual pressure will be shut up between the pressure reducer 3 and the cutoff valve 4 of the lower stream of this pressure reducer 3, at the time of the reboot of the fuel gas apparatus 7 which stopped by a pressure abnormality. It will be in the state where it cannot reboot even if a pressure sensor detects residual pressure, intercepts the cutoff valves 2 and 4 and turns ON an unillustrated ignition key. Therefore, when the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened wide previously, supply of the fuel gas by residual pressure is started to the fuel gas apparatus 7 at the time of the reboot of the fuel gas apparatus 7 and the pressure of the downstream of the pressure reducer 3 falls to less than a predetermined pressure, the cutoff valve 2 of the upper stream of the pressure reducer 3 is opened wide, and supply of fuel gas is started. At this time, the abnormal-stop flow is canceled until it opens the cutoff valve 2 of the upstream. When pressure regulation of the pressure reducer 3 is recovered by this, it can reboot by turning on an ignition key. This statement is equivalent to open directions" in said downstream cutoff valve, when "seizing signal of a claim is inputted.

[0016]

Drawing 2 is a flow chart which shows operation of the fuel gas feed unit 100 concerning one embodiment of this invention, and shows the stop of the fuel gas feed unit 100 and the start method. The fuel gas feed unit 100 assumes that both the cutoff valves 2 and 4 are intercepting

by the abnormalities of a pressure. In the stop of the fuel gas feed unit 100 and the start method of supplying fuel gas to the fuel gas apparatus 7, as shown in drawing 2, For example, if the ignition key of vehicles is turned on (Step S1), By being controlled so that the cutoff valve 4 of the lower stream of the pressure reducer 3 which decompresses fuel gas opens, (Step S2), The residual pressure of fuel gas can be dropped by having remained, for example, consuming fuel gas, such as hydrogen, with a fuel cell between the decompression chamber side 3a of the pressure reducer 3 of the fuel gas feed unit 100 which stopped by a pressure abnormality, and the cutoff valve 4 (between a pressure reducer and the breakers of the downstream). Operation of the fuel gas apparatus 7 (it is also called hydrogen apparatus) is possible even for after a stop of the vehicles which a pressure twists unusually by this by consuming the fuel gas of the downstream of the pressure reducer (regulator) 3. Vehicles can run by changing the fuel gas by this residual pressure into the power energy by operation of the fuel gas apparatus 7. It detects that the pressure sensor 6 is lower than the predetermined pressure set to the decompression chamber side 3a of the pressure reducer 3 at this time (Step S3: in the case of YES), the pressure reducer 3 is judged to be normal, and the cutoff valve 2 of the upper stream of the pressure reducer 3 is released (step S4). In other words, the flow of an abnormal stop is canceled until it opens the cutoff valve of the upstream. Thereby, vehicles can usually be run, for example.

[0017]

If the pressure sensor 8 is usually detected as it being more than a predetermined pressure at the time of a run, etc. (Step S5: in the case of YES), the cutoff valves 2 and 4 of the upper stream of the pressure reducer 3 and the lower stream will be intercepted (Step S6), and supply of the fuel gas to the fuel gas apparatus 7 will be suspended.

[0018]

Since the cutoff valve 4 of the lower stream of the pressure reducer 3 is also closed by this, it is connected with the cutoff valve 4 of this lower stream, and the fuel gas apparatus 7 can be suspended safely.

[0019]

At this time, since the fuel gas apparatus 7 has stopped by the abnormalities of a pressure, as described above, the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened at the time of a reboot (Step S2), it releases residual pressure, and lowers the indicated value of the pressure sensor 6. Thereby, it can check that it can next reboot or start. That is, the good of the pressure reducer 3 and poor diagnosis are attained.

[0020]

By this in the case of starting of the fuel gas apparatus 7, such as an internal-combustion engine or a fuel cell. Since the cutoff valve 2 of the upper stream of the pressure reducer 3 is behind opened when the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened previously and the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 becomes in less than a predetermined pressure, the pressure sensor 6 can check that the pressure in a decompression chamber is less than a predetermined pressure, and can start fuel gas apparatus.

[0021]

Since the predetermined pressure which forms the safety valve 5 in the decompression chamber side 3a of the pressure reducer 3, and closes the cutoff valve 4 is set up lower than the injection-valve-opening-pressure power of the safety valve 5, Even when the very small pressure fluctuation which was not able to be detected when the predetermined pressure which closes the cutoff valve 4 was set up more highly than the injection-valve-opening-pressure power of the safety valve 5 occurs, the defect of the pressure reducer 3 can be detected. Discharge of the fuel gas beyond the necessity of being because a safety valve being opened is avoidable.

[0022]

Drawing 3 is the graph (time chart) which showed the indicated value of the pressure sensor 6 concerning one embodiment of this invention. (a) is a graph which shows the indicated value of the pressure sensor 6 when the pressure reducer 3 is recovered, and (b) is a graph which shows

the indicated value of the pressure sensor 6 in case the pressure reducer 3 is not recovered.  
[0023]

In drawing 3 (a), when the pressure by the side of a decompression chamber exceeds a predetermined pressure, supply of fuel gas stops and the fuel gas apparatus (fuel cell) 7 stops according to the fault of the function of the pressure reducer 3, etc., transition of the pressure shows signs that it reboots. A vertical axis shows the indicated value of the pressure sensor 6, and the horizontal axis shows the time-axis. Usually, the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 usually shows the pressure a (indicated value A on a time-axis). The cutoff valve 2 of the upper stream of the pressure reducer 3 and the downstream cutoff valve 4 are closed here where the indicated value of the pressure sensor 6 will rise if fault occurs in the pressure reducer 3, and the threshold b of poor detection is shown (indicated value B on a time-axis), and supply of fuel gas is suspended. Then, although some indicated value of a pressure sensor rises, as shown in the graph between the indicated value B on the time-axis of drawing 3 (a), and the indicated value C on a time-axis, it changes by a certain pressure. When the safety valve operates by the pressure buildup after suspending supply of fuel gas, fuel gas is emitted and it changes by a certain pressure until it becomes less than the working pressure.

[0024]

If the cutoff valve 4 of the lower stream of the pressure reducer 3 is released when carrying out a reboot after the fuel gas feed unit 100 stops by the abnormalities of a pressure (indicated value C on a time-axis), the indicated value of the pressure sensor 6 will fall and will pass the threshold b of poor detection. Here, if the upstream cutoff valve 2 is opened (indicated value D on a time-axis), the indicated value of the pressure sensor 6 usually reaches the pressure a, and fuel will be supplied to the fuel gas apparatus 7, and it will be rebooted. It may be made to set up a hysteresis as what is different in the threshold b (predetermined pressure) when opening the threshold b (predetermined pressure) and the cutoff valve 2 when intercepting the cutoff valves 2 and 4.

[0025]

Fault occurs in the function of the pressure reducer 3, and the fault of a reducing valve does not cancel drawing 3 (b) at the time of the reboot after supply of fuel gas stops and the fuel gas apparatus 7 stops, but the graph shows signs that the fuel gas apparatus 7 stops again. the indicated value D on a time-axis [ in / in transition of the pressure of this graph / drawing 3 (a) ] -- until -- the indicated value of the pressure sensor 6, if it is the same and the cutoff valve 2 of the upper stream of the pressure reducer 3 is opened (indicated value D on a time-axis), Since the pressure by the side of [ 3a ] a decompression chamber is not decompressed when the fault of the pressure reducer 3 is not canceled, although it once falls, it begins to go up immediately and the threshold b of the poor detection which detects the fault of the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 is exceeded. Therefore, the cutoff valves 2 and 4 close with directions of the pressure sensor 6 (indicated value E on a time-axis), and supply of fuel gas is suspended. Thus, when the pressure reducer 3 which stopped by the abnormalities of the pressure is not recovered at the time of the reboot of fuel gas apparatus, the pressure sensor 6 detects the defect of the pressure reducer 3, and the safety valve 5 is operating. The pressure between said pressure reducer 3 and said downstream cutoff valve 4 means including the pressure in a decompression chamber.

[0026]

Therefore, the pressure sensor 6 which detects the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 according to this embodiment, If it has the cutoff valves 2 and 4 in the upper stream and the lower stream of the pressure reducer 3 and the pressure of the decompression chamber of the pressure reducer 3 becomes more than a predetermined pressure, will intercept the two cutoff valves 2 and 4 simultaneously, and in the case of the reboot of the fuel gas apparatus 7. When the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened previously and the pressure by the side of [ 3a ] a decompression chamber becomes in less than a predetermined pressure, the problem which the reboot of the fuel gas apparatus 7 of was attained, and was described above is solved by opening

the cutoff valve 2 of the upper stream of the pressure reducer 3. When the safety valve 5 is formed in the decompression chamber side 3a of the pressure reducer 3 by this invention, the reboot of the fuel gas apparatus 7 is attained irrespective of setting out of the predetermined pressure which closes the cutoff valves 2 and 4. The defect of the pressure reducer 3 is detectable also in the case which change of the very small pressure which was not able to be detected when the predetermined pressure which closes the cutoff valves 2 and 4 was set up more highly than the injection-valve-opening-pressure power of the safety valve 5 by setting up lower than the injection-valve-opening-pressure power of the safety valve 5 the predetermined pressure which closes the cutoff valves 2 and 4 generates.

[0027]

The embodiment described above is an example for explaining this invention, this invention is not limited to the aforementioned embodiment and various change is possible for it within the limits of the gist of an invention. For example, in this embodiment, although fuel gas apparatus was explained about what is used loading a car, it is also applicable to a marine vessel, an airplane, etc. It is also applicable also to ground installation type (fixed type) fuel gas apparatus.

[0028]

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]****[Field of the Invention]**

This invention relates to the stop of a fuel gas feed unit and the start method of decompressing high pressure gas with a pressure reducer, and supplying to fuel gas apparatus, such as an internal-combustion engine or a fuel cell, as fuel gas, and relates to the stop of a fuel gas feed unit and the start method at the time of the pressure abnormality of a pressure reducer especially.

**[0002]****[Description of the Prior Art]**

It is what intercepts fuel gas in the fuel piping system which supplies fuel gas to fuel gas apparatus which used high pressure gas as fuel conventionally, such as an internal-combustion engine and a fuel cell, at the time of the abnormalities of a pressure. The decompression chamber side of the pressure reducer which decompresses high pressure gas is equipped with the pressure sensor which detects the pressure of a decompression chamber, and when it detects that the pressure in a decompression chamber became more than the predetermined pressure, there is a fuel gas feed unit controlled to close the cutoff valve which is upstream of a pressure reducer.

**[0003]**

Although the safety valve which it had downstream from the decompression chamber operates and the inside of a decompression chamber is decompressed, also when a safety valve breaks down, the safeguard of the pressure reducer for fuel gas which intercepts the passage of high pressure gas by the cutoff valve of fuel is known (for example, refer to patent documents 1). When a defect occurs in the pressure regulation mechanism of a pressure reducer by a certain cause and the pressure in a decompression chamber becomes more than a predetermined pressure, this detects this with a pressure sensor and is intercepting the passage of high pressure gas by driving the cutoff valve of fuel. Impression of the high pressure gas to a low-pressure-pipes system can be prevented beforehand by this, and breakage of low-pressure-pipes parts can be avoided. When the safety valve is provided, the safety valve operates first, and the inside of a decompression chamber is decompressed, but also when a safety valve breaks down, the abnormal pressure in a decompression chamber is detected with a pressure sensor, and the passage of high pressure gas is intercepted by the fuel emergency trip valve.

**[0004]****[Patent documents 1]**

JP,63-41651,A (the 8th page, Drawing 2)

**[0005]****[Problem(s) to be Solved by the Invention]**

By the way, in the case where intercept not only the cutoff valve of the upper stream of a pressure reducer but a downstream cutoff valve, and the whole system of fuel gas apparatus is stopped at the time of the fault of the pressure in a decompression chamber, etc., Since the pressure more than a predetermined pressure was confined in the decompression chamber side,

- even when the function of a pressure reducer was recovered, the reboot of fuel gas apparatus might not be completed. That is, for the pressure confined in the decompression chamber side, the pressure sensor detected the pressure reducer as poor, and there was a problem that fuel gas apparatus could not be rebooted.

[0006]

If setting out of the pressure which closes the cutoff valve of the upper stream of a pressure reducer is set up more highly than the injection-valve opening pressure of a safety valve when a safety valve is provided in the decompression chamber side of a pressure reducer, Even when were set up low for the pressure by the side of a decompression chamber to be unable to detect the very small pressure fluctuation which changes near the injection-valve-opening-pressure power of a safety valve at the time of the fault of a pressure reducer, and have described above, and it changed into the state where the pressure more than a setting pressure was confined in the decompression chamber side and the function of a pressure reducer was recovered, there was a problem that a reboot was impossible.

[0007]

This invention is made in order to solve said technical problem, and it is a thing.

The purpose is to provide the stop of a fuel gas feed unit and the start method of rebooting fuel gas apparatus easily, when the function of a pressure reducer is recovered after \*\* became unusual and stopped.

[0008]

[Means for Solving the Problem]

The invention according to claim 1 of this inventions which solved said technical problem, When a pressure of the downstream of a pressure reducer which is a stop of a fuel gas feed unit and a start method of supplying fuel gas to fuel gas apparatus, and decompresses fuel gas is more than a predetermined pressure, Intercept a cutoff valve of the upper stream of said pressure reducer, and the lower stream, stop, and supply of fuel gas to said fuel gas apparatus at the time of a reboot of said fuel gas apparatus. When said cutoff valve of the lower stream of said pressure reducer is opened wide, supply of fuel gas to said fuel gas apparatus is started and a pressure of the downstream of said pressure reducer falls to less than a predetermined pressure, said cutoff valve of the upper stream of said pressure reducer is opened wide, and supply of fuel gas to said fuel gas apparatus is started.

[0009]

In order that a pressure of the downstream of said pressure reducer may intercept simultaneously two cutoff valves provided in the upper stream and the lower stream of a pressure reducer which detect as poor [ become / more than a predetermined pressure ] in a pressure reducer, and decompress said fuel gas according to the invention according to claim 1, Fuel gas apparatus connected with a cutoff valve of the lower stream of a pressure reducer can be suspended safely.

[0010]

At the time of a reboot of fuel gas apparatus, such as an internal-combustion engine or a fuel cell. When a cutoff valve of the lower stream of a pressure reducer is opened previously, supply of fuel gas is started to fuel gas apparatus and a pressure of the downstream of a pressure reducer becomes in less than a predetermined pressure, in order to open a cutoff valve of the upper stream of a pressure reducer behind, The pressure sensor can check that a pressure in a decompression chamber is less than a predetermined pressure, and can reboot fuel gas apparatus easily. When fault of a pressure reducer is solved, operation of fuel gas apparatus can be resumed.

[0011]

A pressure reducer with which the invention according to claim 2 decompresses fuel gas, and a cutoff valve of the upstream arranged at the upstream of said pressure reducer, A pressure sensor which detects a pressure between a cutoff valve of the downstream arranged at the downstream of said pressure reducer, and said pressure reducer and a cutoff valve of said downstream, Are a control means which directs interception and opening of a cutoff valve of said

upstream, and a cutoff valve of said downstream an included fuel gas feed unit, and said control means, If a pressure which will carry out the open directions of the cutoff valve of said downstream, and will be detected by said pressure sensor if a seizing signal is inputted becomes below predetermined pressure, the open directions of the cutoff valve of said upstream will be carried out.

[0012]

According to the invention according to claim 2, said control means, If a pressure which will carry out the open directions of the cutoff valve of said downstream, and will be detected by said pressure sensor if a seizing signal is inputted becomes below predetermined pressure, in order to carry out the open directions of the cutoff valve of said upstream, When a function of a pressure reducer is recovered after a pressure of a pressure reducer having become unusual and stopping, fuel gas apparatus can be rebooted easily.

[0013]

#### [Embodiment of the Invention]

The stop of a fuel gas feed unit and the start method concerning this invention are explained with reference to drawings. Drawing 1 is a schematic diagram showing the composition of the fuel gas feed unit 100 concerning one embodiment of this invention. In drawing 1, the fuel gas feed unit 100 is carried in the unillustrated fuel gas car. In this fuel gas feed unit 100, the pressure of the fuel tank 1 in which high pressure gas fuel is stored is decompressed by the desired pressure with the pressure reducer 3, and this decompressed fuel gas is supplied to the fuel gas apparatus 7, such as fuel \*\*\* or an internal-combustion engine. A stop and start of supply of fuel gas are performed by the cutoff valve 2 of the upper stream of the pressure reducer 3, and the downstream cutoff valve 4. The cutoff valve 2 of a besides style is a cutoff valve of the yne tank equipped in the fuel tank 1. The fuel gas apparatus 7 is connected to the downstream cutoff valve 4. Here, the fuel tank 1 in which high pressure gas fuel is stored is made into the upstream, and the fuel gas apparatus 7 is made into the downstream. Between the cutoff valves 4, it has the safety valve 5 the decompression chamber side 3a of the pressure reducer 3. The pressure sensor 6 is formed between the pressure reducer 3 and the safety valve 5, and the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 is detected. These cutoff valves 2 and 4 and pressure sensors 6 are connected to the control device 8 which controls the fuel gas feed unit 100. About the details of the function of a control device (control means), it clarifies with reference to a flow chart etc. later.

[0014]

Next, a stop of the fuel gas feed unit 100 and the start method provided with the above composition are explained. In the fuel gas feed unit 100 which supplies high pressure gas fuel to the fuel gas apparatus 7, such as an internal-combustion engine or a fuel cell, via the pressure reducer 3 as shown in drawing 1, If the upper stream and the lower stream of the pressure sensor 6 and the pressure reducer 3 which detect the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 are equipped with the cutoff valves 2 and 4 and the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 turns into more than a predetermined pressure, The cutoff valve 2 of the upper stream of the pressure reducer 3 and the downstream cutoff valve 4 are intercepted almost simultaneous, and supply of the fuel gas to the fuel gas apparatus 7 is suspended.

[0015]

In such a fuel piping system, since residual pressure will be shut up between the pressure reducer 3 and the cutoff valve 4 of the lower stream of this pressure reducer 3, at the time of the reboot of the fuel gas apparatus 7 which stopped by a pressure abnormality. It will be in the state where it cannot reboot even if a pressure sensor detects residual pressure, intercepts the cutoff valves 2 and 4 and turns ON an unillustrated ignition key. Therefore, when the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened wide previously, supply of the fuel gas by residual pressure is started to the fuel gas apparatus 7 at the time of the reboot of the fuel gas apparatus 7 and the pressure of the downstream of the pressure reducer 3 falls to less than a predetermined pressure, the cutoff valve 2 of the upper stream of the pressure reducer 3 is opened wide, and supply of fuel gas is started. At this time, the abnormal-stop flow is canceled

until it opens the cutoff valve 2 of the upstream. When pressure regulation of the pressure reducer 3 is recovered by this, it can reboot by turning on an ignition key. This statement is equivalent to open directions" in said downstream cutoff valve, when "seizing signal of a claim is inputted.

[0016]

Drawing 2 is a flow chart which shows operation of the fuel gas feed unit 100 concerning one embodiment of this invention, and shows the stop of the fuel gas feed unit 100 and the start method. The fuel gas feed unit 100 assumes that both the cutoff valves 2 and 4 are intercepting by the abnormalities of a pressure. In the stop of the fuel gas feed unit 100 and the start method of supplying fuel gas to the fuel gas apparatus 7, as shown in drawing 2. For example, if the ignition key of vehicles is turned on (Step S1), By being controlled so that the cutoff valve 4 of the lower stream of the pressure reducer 3 which decompresses fuel gas opens, (Step S2), The residual pressure of fuel gas can be dropped by having remained, for example, consuming fuel gas, such as hydrogen, with a fuel cell between the decompression chamber side 3a of the pressure reducer 3 of the fuel gas feed unit 100 which stopped by a pressure abnormality, and the cutoff valve 4 (between a pressure reducer and the breakers of the downstream). Operation of the fuel gas apparatus 7 (it is also called hydrogen apparatus) is possible even for after a stop of the vehicles which a pressure twists unusually by this by consuming the fuel gas of the downstream of the pressure reducer (regulator) 3. Vehicles can run by changing the fuel gas by this residual pressure into the power energy by operation of the fuel gas apparatus 7. It detects that the pressure sensor 6 is lower than the predetermined pressure set to the decompression chamber side 3a of the pressure reducer 3 at this time (Step S3: in the case of YES), the pressure reducer 3 is judged to be normal, and the cutoff valve 2 of the upper stream of the pressure reducer 3 is released (step S4). In other words, the flow of an abnormal stop is canceled until it opens the cutoff valve of the upstream. Thereby, vehicles can usually be run, for example.

[0017]

If the pressure sensor 8 is usually detected as it being more than a predetermined pressure at the time of a run, etc. (Step S5: in the case of YES), the cutoff valves 2 and 4 of the upper stream of the pressure reducer 3 and the lower stream will be intercepted (Step S6), and supply of the fuel gas to the fuel gas apparatus 7 will be suspended.

[0018]

Since the cutoff valve 4 of the lower stream of the pressure reducer 3 is also closed by this, it is connected with the cutoff valve 4 of this lower stream, and the fuel gas apparatus 7 can be suspended safely.

[0019]

At this time, since the fuel gas apparatus 7 has stopped by the abnormalities of a pressure, as described above, the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened at the time of a reboot (Step S2), it releases residual pressure, and lowers the indicated value of the pressure sensor 6. Thereby, it can check that it can next reboot or start. That is, the good of the pressure reducer 3 and poor diagnosis are attained.

[0020]

By this in the case of starting of the fuel gas apparatus 7, such as an internal-combustion engine or a fuel cell. Since the cutoff valve 2 of the upper stream of the pressure reducer 3 is behind opened when the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened previously and the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 becomes in less than a predetermined pressure, the pressure sensor 6 can check that the pressure in a decompression chamber is less than a predetermined pressure, and can start fuel gas apparatus.

[0021]

Since the predetermined pressure which forms the safety valve 5 in the decompression chamber side 3a of the pressure reducer 3, and closes the cutoff valve 4 is set up lower than the injection-valve-opening-pressure power of the safety valve 5, Even when the very small pressure fluctuation which was not able to be detected when the predetermined pressure which

closes the cutoff valve 4 was set up more highly than the injection-valve-opening-pressure power of the safety valve 5 occurs, the defect of the pressure reducer 3 can be detected. Discharge of the fuel gas beyond the necessity of being because a safety valve being opened is avoidable.

[0022]

Drawing 3 is the graph (time chart) which showed the indicated value of the pressure sensor 6 concerning one embodiment of this invention. (a) is a graph which shows the indicated value of the pressure sensor 6 when the pressure reducer 3 is recovered, and (b) is a graph which shows the indicated value of the pressure sensor 6 in case the pressure reducer 3 is not recovered.

[0023]

In drawing 3 (a), when the pressure by the side of a decompression chamber exceeds a predetermined pressure, supply of fuel gas stops and the fuel gas apparatus (fuel cell) 7 stops according to the fault of the function of the pressure reducer 3, etc., transition of the pressure shows signs that it reboots. A vertical axis shows the indicated value of the pressure sensor 6, and the horizontal axis shows the time-axis. Usually, the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 usually shows the pressure a (indicated value A on a time-axis). The cutoff valve 2 of the upper stream of the pressure reducer 3 and the downstream cutoff valve 4 are closed here where the indicated value of the pressure sensor 6 will rise if fault occurs in the pressure reducer 3, and the threshold b of poor detection is shown (indicated value B on a time-axis), and supply of fuel gas is suspended. Then, although some indicated value of a pressure sensor rises, as shown in the graph between the indicated value B on the time-axis of drawing 3 (a), and the indicated value C on a time-axis, it changes by a certain pressure. When the safety valve operates by the pressure buildup after suspending supply of fuel gas, fuel gas is emitted and it changes by a certain pressure until it becomes less than the working pressure.

[0024]

If the cutoff valve 4 of the lower stream of the pressure reducer 3 is released when carrying out a reboot after the fuel gas feed unit 100 stops by the abnormalities of a pressure (indicated value C on a time-axis), the indicated value of the pressure sensor 6 will fall and will pass the threshold b of poor detection. Here, if the upstream cutoff valve 2 is opened (indicated value D on a time-axis), the indicated value of the pressure sensor 6 usually reaches the pressure a, and fuel will be supplied to the fuel gas apparatus 7, and it will be rebooted. It may be made to set up a hysteresis as what is different in the threshold b (predetermined pressure) when opening the threshold b (predetermined pressure) and the cutoff valve 2 when intercepting the cutoff valves 2 and 4.

[0025]

Fault occurs in the function of the pressure reducer 3, and the fault of a reducing valve does not cancel drawing 3 (b) at the time of the reboot after supply of fuel gas stops and the fuel gas apparatus 7 stops, but the graph shows signs that the fuel gas apparatus 7 stops again. the indicated value D on a time-axis [ in / in transition of the pressure of this graph / drawing 3 (a) ] -- until -- the indicated value of the pressure sensor 6, if it is the same and the cutoff valve 2 of the upper stream of the pressure reducer 3 is opened (indicated value D on a time-axis), Since the pressure by the side of [ 3a ] a decompression chamber is not decompressed when the fault of the pressure reducer 3 is not canceled, although it once falls, it begins to go up immediately and the threshold b of the poor detection which detects the fault of the pressure by the side of [ 3a ] the decompression chamber of the pressure reducer 3 is exceeded. Therefore, the cutoff valves 2 and 4 close with directions of the pressure sensor 6 (indicated value E on a time-axis), and supply of fuel gas is suspended. Thus, when the pressure reducer 3 which stopped by the abnormalities of the pressure is not recovered at the time of the reboot of fuel gas apparatus, the pressure sensor 6 detects the defect of the pressure reducer 3, and the safety valve 5 is operating. The pressure between said pressure reducer 3 and said downstream cutoff valve 4 means including the pressure in a decompression chamber.

[0026]

Therefore, the pressure sensor 6 which detects the pressure by the side of [ 3a ] the

decompression chamber of the pressure reducer 3 according to this embodiment. If it has the cutoff valves 2 and 4 in the upper stream and the lower stream of the pressure reducer 3 and the pressure of the decompression chamber of the pressure reducer 3 becomes more than a predetermined pressure, will intercept the two cutoff valves 2 and 4 simultaneously, and in the case of the reboot of the fuel gas apparatus 7. When the cutoff valve 4 of the lower stream of the pressure reducer 3 is opened previously and the pressure by the side of [ 3a ] a decompression chamber becomes in less than a predetermined pressure, the problem which the reboot of the fuel gas apparatus 7 of was attained, and was described above is solved by opening the cutoff valve 2 of the upper stream of the pressure reducer 3. When the safety valve 5 is formed in the decompression chamber side 3a of the pressure reducer 3 by this invention, the reboot of the fuel gas apparatus 7 is attained irrespective of setting out of the predetermined pressure which closes the cutoff valves 2 and 4. The defect of the pressure reducer 3 is detectable also in the case which change of the very small pressure which was not able to be detected when the predetermined pressure which closes the cutoff valves 2 and 4 was set up more highly than the injection-valve-opening-pressure power of the safety valve 5 by setting up lower than the injection-valve-opening-pressure power of the safety valve 5 the predetermined pressure which closes the cutoff valves 2 and 4 generates.

[0027]

The embodiment described above is an example for explaining this invention, this invention is not limited to the aforementioned embodiment and various change is possible for it within the limits of the gist of an invention. For example, in this embodiment, although fuel gas apparatus was explained about what is used loading a car, it is also applicable to a marine vessel, an airplane, etc. It is also applicable also to ground installation type (fixed type) fuel gas apparatus.

[0028]

[Effect of the Invention]

It detects as poor [ become / the pressure of the downstream of a pressure reducer / more than a predetermined pressure ] in a pressure reducer according to the invention according to claim 1, as explained above. Since two cutoff valves provided in the upper stream and the lower stream of the pressure reducer which decompress fuel gas are intercepted simultaneously, the fuel gas apparatus connected with the cutoff valve of the lower stream of a pressure reducer can be suspended safely.

[0029]

At the time of the reboot of fuel gas apparatus, such as an internal-combustion engine or a fuel cell. When the cutoff valve of the lower stream of a pressure reducer is opened previously, supply of fuel gas is started to fuel gas apparatus and the pressure of the downstream of a pressure reducer becomes in less than a predetermined pressure, in order to open the cutoff valve of the upper stream of a pressure reducer behind. The pressure sensor can check that the pressure in a decompression chamber is less than a predetermined pressure, and can reboot fuel gas apparatus easily. When the fault of a pressure reducer is solved, operation of fuel gas apparatus can be resumed.

[0030]

According to the invention according to claim 2, when the function of a pressure reducer is recovered after the pressure of the pressure reducer having become unusual and stopping, fuel gas apparatus can be rebooted easily.

[Brief Description of the Drawings]

[Drawing 1] It is a schematic diagram showing the composition of the fuel gas feed unit concerning one embodiment of this invention.

[Drawing 2] It is a flow chart which shows operation of the fuel gas feed unit concerning one embodiment of this invention.

[Drawing 3] It is a graph which shows the indicated value of the pressure sensor concerning one embodiment of this invention, and (a) shows the case where a pressure reducer is recovered and (b) shows the case where the pressure reducer is not recovered.

[Description of Notations]

1 Fuel tank

- 2 and 4 Cutoff valve
- 3 Pressure reducer
- 3a Decompression chamber side
- 5 Safety valve
- 6 Pressure sensor
- 7 Fuel gas apparatus
- 8 Control device
- 100 Fuel gas feed unit

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[Translation done.]

**\* NOTICES \***

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]**It is a schematic diagram showing the composition of the fuel gas feed unit concerning one embodiment of this invention.

**[Drawing 2]**It is a flow chart which shows operation of the fuel gas feed unit concerning one embodiment of this invention.

**[Drawing 3]**It is a graph which shows the indicated value of the pressure sensor concerning one embodiment of this invention, and (a) shows the case where a pressure reducer is recovered and (b) shows the case where the pressure reducer is not recovered.

**[Description of Notations]**

1 Fuel tank

2 and 4 Cutoff valve

3 Pressure reducer

3a Decompression chamber side

5 Safety valve

6 Pressure sensor

7 Fuel gas apparatus

8 Control device

100 Fuel gas feed unit

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**[Translation done.]**

**\* NOTICES \***

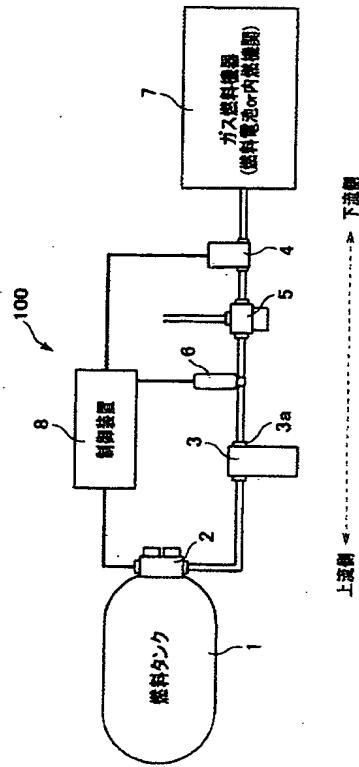
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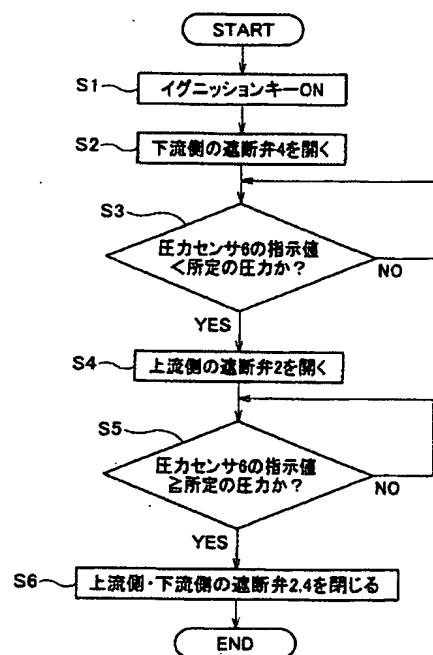
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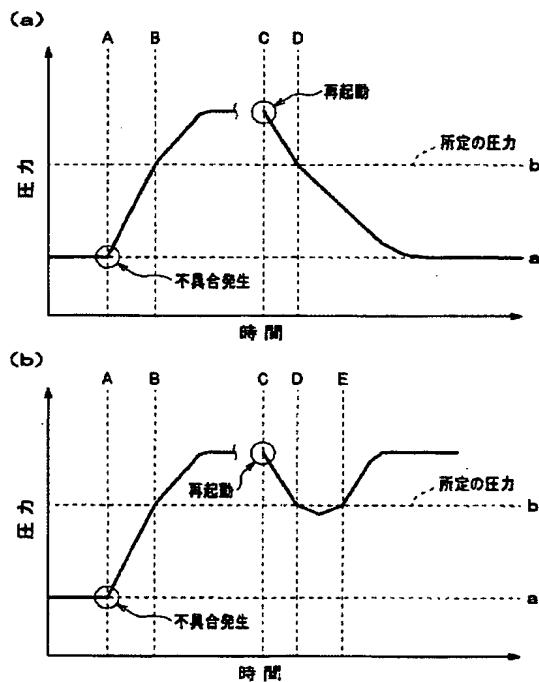
**DRAWINGS**

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**[Drawing 1]****[Drawing 2]**



[Drawing 3]



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(54) 【発明の名称】ガス燃料供給装置の停止および開始方法、並びにガス燃料供給装置

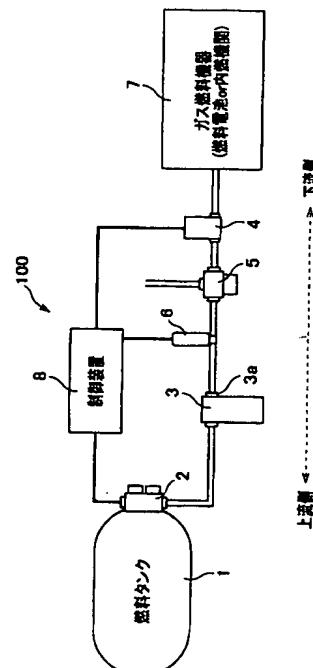
## (57) 【要約】

【課題】減圧器の圧力が異常となって停止した後でも、ガス燃料機器を安全に停止することができ、また、減圧器の機能が回復した場合、ガス燃料機器を容易に再起動できるガス燃料供給装置を提供する。

【解決手段】高圧ガス燃料を減圧器3を介して内燃機関もしくは燃料電池などのガス燃料機器7に供給するガス燃料供給装置100であって、減圧器3の減圧室側3aに圧力センサ6と、減圧器3の上流および下流に遮断弁2、4とを備え、減圧器3の減圧室側3aの圧力が所定の圧力以上となると、2つの遮断弁2、4を同時に遮断し、ガス燃料機器7の再起動の際は減圧器3の下流の遮断弁4を先に開き、減圧室側3aの圧力が所定の圧力未満となったとき、減圧器3の上流の遮断弁2を開く。

【選択図】

図 1



【特許請求の範囲】

【請求項 1】

ガス燃料機器へ燃料ガスを供給するガス燃料供給装置の停止および開始方法であって、燃料ガスを減圧する減圧器の下流側の圧力が所定の圧力以上の場合には、前記減圧器の上流および下流の遮断弁を遮断し、前記ガス燃料機器への燃料ガスの供給を停止し、前記ガス燃料機器の再起動時には、前記減圧器の下流の前記遮断弁を開放し、前記ガス燃料機器への燃料ガスの供給を開始し、前記減圧器の下流側の圧力が所定の圧力未満まで下がったときに、前記減圧器の上流の前記遮断弁を開放し、前記ガス燃料機器への燃料ガスの供給を開始することを特徴とするガス燃料供給装置の停止および開始方法。

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【請求項 2】

燃料ガスを減圧する減圧器と、前記減圧器の上流側に配置された上流側の遮断弁と、前記減圧器の下流側に配置された下流側の遮断弁と、前記減圧器と前記下流側の遮断弁との間の圧力を検知する圧力センサと、前記上流側の遮断弁及び前記下流側の遮断弁の遮断・開放を指示する制御手段とを含んでなるガス燃料供給装置であって、前記制御手段は、

起動信号を入力すると、前記下流側の遮断弁を開放指示し、前記圧力センサにより検知される圧力が所定圧以下になると、前記上流側の遮断弁を開放指示することを特徴とするガス燃料供給装置。

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【発明の詳細な説明】

【0001】

【発明の属する技術分野】

本発明は、高圧ガスを減圧して内燃機関、もしくは燃料電池などのガス燃料機器へ燃料ガスとして供給するガス燃料供給装置の停止および開始方法に関し、特に、減圧器の圧力異常時におけるガス燃料供給装置の停止および開始方法に関する。

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【0002】

【従来の技術】

従来、高圧ガスを燃料とした内燃機関や燃料電池などのガス燃料機器に燃料ガスを供給する燃料配管系において、圧力の異常時に燃料ガスを遮断するもので、高圧ガスを減圧する減圧器の減圧室側に減圧室の圧力を検出する圧力センサを備え、減圧室内の圧力が所定の圧力以上になったことを検知したとき、減圧器の上流にある遮断弁を閉じるように制御されるガス燃料供給装置がある。

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【0003】

また、減圧室の下流に備えられた安全弁が作動して減圧室内を減圧するが、安全弁が故障した場合にも、高圧ガスの通路を燃料の遮断弁で遮断するガス燃料用減圧器の安全装置が知られている（例えば、特許文献1参照）。これは、何らかの原因により減圧器の調圧機構に不良が発生し、減圧室内の圧力が所定の圧力以上になった場合に、圧力センサによりこれを検知し、燃料の遮断弁を駆動することにより高圧ガスの通路を遮断している。これにより低圧配管系への高圧ガスの印加を未然に防止することができ、低圧配管部品の破損を回避することができる。また、安全弁が設けられている場合には、安全弁がまず作動して減圧室内を減圧するが、安全弁が故障した場合にも、圧力センサにより減圧室内の異常圧力を検知し、高圧ガスの通路を燃料遮断弁で遮断している。

【0004】

【特許文献1】

特開昭63-41651号公報（第8頁、第2図）

【0005】

【発明が解決しようとする課題】

ところで、減圧室内の圧力の不具合時などに、減圧器の上流の遮断弁だけでなく、下流の遮断弁も遮断してガス燃料機器のシステム全体を停止してしまう場合においては、減圧室側に所定の圧力以上の圧力が封じ込められるため、減圧器の機能が回復した場合でもガス

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燃料機器の再起動ができないことがあった。つまり、減圧室側に封じ込められている圧力のため、圧力センサが減圧器を不良として検知してしまい、ガス燃料機器を再起動することができないという問題があった。

#### 【0006】

さらに、減圧器の減圧室側に安全弁を設けた場合、減圧器の上流の遮断弁を閉じる圧力の設定を安全弁の開弁圧よりも高く設定すると、減圧器の不具合時に減圧室側の圧力が安全弁の開弁圧力付近で推移する微少な圧力変動を検知できず、また、前記したように低く設定すると減圧室側に設定圧力以上の圧力が封じ込められた状態になり、減圧器の機能が回復した場合でも再起動ができないという問題があった。

#### 【0007】

本発明は、前記課題を解決するためになされたものであり、減圧器の圧力が異常となって停止した後、減圧器の機能が回復した場合、ガス燃料機器を容易に再起動することができるガス燃料供給装置の停止および開始方法を提供することを目的とする。

#### 【0008】

##### 【課題を解決するための手段】

前記課題を解決した本発明のうちの請求項1に記載の発明は、ガス燃料機器へ燃料ガスを供給するガス燃料供給装置の停止および開始方法であって、燃料ガスを減圧する減圧器の下流側の圧力が所定の圧力以上の場合には、前記減圧器の上流および下流の遮断弁を遮断し、前記ガス燃料機器への燃料ガスの供給を停止し、前記ガス燃料機器の再起動時には、前記減圧器の下流の前記遮断弁を開放し、前記ガス燃料機器への燃料ガスの供給を開始し、前記減圧器の下流側の圧力が所定の圧力未満まで下がったときに、前記減圧器の上流の前記遮断弁を開放し、前記ガス燃料機器への燃料ガスの供給を開始することを特徴とする。

#### 【0009】

請求項1に記載の発明によれば、前記減圧器の下流側の圧力が所定の圧力以上になると減圧器を不良として検知し、前記燃料ガスを減圧する減圧器の上流および下流に設けられた2つの遮断弁を同時に遮断するため、減圧器の下流の遮断弁と接続されているガス燃料機器を安全に停止することができる。

#### 【0010】

また、内燃機関もしくは燃料電池などのガス燃料機器の再起動時には、減圧器の下流の遮断弁を先に開き、ガス燃料機器へ燃料ガスの供給を開始し、減圧器の下流側の圧力が所定の圧力未満となったとき、減圧器の上流の遮断弁を後に開くため、圧力センサは減圧室側の圧力が所定の圧力未満であることを確認し、ガス燃料機器を容易に再起動することができる。さらに、減圧器の不具合が解消した場合にはガス燃料機器の運転を再開することができる。

#### 【0011】

請求項2に記載の発明は、燃料ガスを減圧する減圧器と、前記減圧器の上流側に配置された上流側の遮断弁と、前記減圧器の下流側に配置された下流側の遮断弁と、前記減圧器と前記下流側の遮断弁との間の圧力を検知する圧力センサと、前記上流側の遮断弁及び前記下流側の遮断弁の遮断・開放を指示する制御手段とを含んでなるガス燃料供給装置であつて、前記制御手段は、起動信号を入力すると、前記下流側の遮断弁を開放指示し、前記圧力センサにより検知される圧力が所定圧以下になると、前記上流側の遮断弁を開放指示することを特徴とする。

#### 【0012】

請求項2に記載の発明によれば、前記制御手段は、起動信号を入力すると、前記下流側の遮断弁を開放指示し、前記圧力センサにより検知される圧力が所定圧以下になると、前記上流側の遮断弁を開放指示するため、減圧器の圧力が異常となって停止した後、減圧器の機能が回復した場合、ガス燃料機器を容易に再起動することができる。

#### 【0013】

##### 【発明の実施の形態】

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本発明に係るガス燃料供給装置の停止および開始方法について図面を参照して説明する。図1は、本発明の一実施形態に係るガス燃料供給装置100の構成を示す概略図である。図1において、ガス燃料供給装置100は、不図示のガス燃料自動車に搭載されている。このガス燃料供給装置100において、高圧ガス燃料を貯蔵する燃料タンク1の圧力は、減圧器3によって所望の圧力に減圧され、この減圧された燃料ガスが燃料屯池もしくは内燃機関などのガス燃料機器7へ供給される。また、燃料ガスの供給の停止や開始は、減圧器3の上流の遮断弁2および下流の遮断弁4によって行われる。この上流の遮断弁2は、燃料タンク1内に装備されたインタンクの遮断弁である。また下流の遮断弁4にはガス燃料機器7が接続されている。ここでは高圧ガス燃料を貯蔵する燃料タンク1を上流側、ガス燃料機器7を下流側としている。また、減圧器3の減圧室側3aと遮断弁4との間には安全弁5を備えている。また、減圧器3と安全弁5との間に圧力センサ6を設けており、減圧器3の減圧室側3aの圧力を検出している。これらの遮断弁2、4及び圧力センサ6は、ガス燃料供給装置100を制御する制御装置8に接続されている。尚、制御装置（制御手段）の機能の詳細については、フローチャートなどを参照して、後で明らかにする。

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#### 【0014】

次に、以上の構成を備えたガス燃料供給装置100の停止および開始方法について説明する。図1に示すように、高圧ガス燃料を減圧器3を介して内燃機関もしくは燃料電池などのガス燃料機器7に供給するガス燃料供給装置100において、減圧器3の減圧室側3aの圧力を検知する圧力センサ6と減圧器3の上流および下流に遮断弁2、4を備え、減圧器3の減圧室側3aの圧力が所定の圧力以上となると、減圧器3の上流の遮断弁2と下流の遮断弁4をほぼ同時に遮断して、ガス燃料機器7への燃料ガスの供給を停止する。

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#### 【0015】

このような燃料配管系において、減圧器3と、この減圧器3の下流の遮断弁4との間に残圧が閉じ込められてしまうため、圧力異常ににより停止したガス燃料機器7の再起動時には、圧力センサが残圧を検知して遮断弁2、4を遮断してしまい、不図示のイグニッショングキーをONにしても再起動できない状態になる。そのため、ガス燃料機器7の再起動時には、減圧器3の下流の遮断弁4を先に開放し、ガス燃料機器7へ残圧による燃料ガスの供給を開始し、減圧器3の下流側の圧力が所定の圧力未満まで下がったときに、減圧器3の上流の遮断弁2を開放し、燃料ガスの供給を開始する。このとき、上流側の遮断弁2を開放するまで異常停止フローをキャンセルしておく。これにより減圧器3の調圧が回復した場合、イグニッショングキーをONすることにより再起動することができる。尚、この記載は請求項の「起動信号を入力すると、前記下流側遮断弁を開放指示」に相当する。

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#### 【0016】

図2は、本発明の一実施形態に係るガス燃料供給装置100の動作を示すフローチャートであり、ガス燃料供給装置100の停止および開始方法を示している。尚、ガス燃料供給装置100は圧力の異常ににより両遮断弁2、4が遮断しているものとする。図2に示すように、ガス燃料機器7へ燃料ガスを供給するガス燃料供給装置100の停止および開始方法において、たとえば、車両のイグニッショングキーをONすると（ステップS1）、燃料ガスを減圧する減圧器3の下流の遮断弁4が開くように制御されることにより（ステップS2）、圧力異常で停止したガス燃料供給装置100の減圧器3の減圧室側3aと遮断弁4との間（減圧器と下流側の遮断器との間）に残留した、たとえば水素などの燃料ガスを燃料電池で消費することで、燃料ガスの残圧を下げることができる。これにより圧力の異常による車両の停止後も、減圧器（レギュレータ）3の下流側の燃料ガスを消費することによって、ガス燃料機器7（水素機器とも言う）の運転が可能である。車両は、この残圧による燃料ガスをガス燃料機器7の運転による動力エネルギーに変換することによって走行することができる。このとき圧力センサ6が、減圧器3の減圧室側3aに設定された所定の圧力より低いことを検出し（ステップS3：YESの場合）、減圧器3を正常と判断し、減圧器3の上流の遮断弁2を解放する（ステップS4）。言い換えると、上流側の遮断弁を開放するまでは異常停止のフローをキャンセルしている。これにより、たとえば車両は通常走行を行える。

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**【0017】**

また、通常走行時などに圧力センサ8が所定の圧力以上であると検知されると（ステップS5：YESの場合）、減圧器3の上流および下流の遮断弁2、4が遮断され（ステップS6）、ガス燃料機器7への燃料ガスの供給を停止する。

**【0018】**

これにより減圧器3の下流の遮断弁4も閉じられるため、この下流の遮断弁4と接続されてガス燃料機器7を安全に停止することができる。

**【0019】**

このときガス燃料機器7は、圧力の異常によって停止しているため、再起動のときは、前記したように、減圧器3の下流の遮断弁4を開けて（ステップS2）、残圧を解放し、圧力センサ6の指示値を下げる。これにより、次に再起動または始動できることを確認することができる。つまり減圧器3の良・不良の診断が可能となる。

**【0020】**

これにより、内燃機関もしくは燃料電池などのガス燃料機器7の起動の際は、減圧器3の下流の遮断弁4を先に開き、減圧器3の減圧室側3aの圧力が所定の圧力未満となったとき、減圧器3の上流の遮断弁2を後に開くため、圧力センサ6は減圧室内の圧力が所定の圧力未満であることを確認し、ガス燃料機器の起動をすることができる。

**【0021】**

また、減圧器3の減圧室側3aに安全弁5を設け、遮断弁4を閉じる所定の圧力を安全弁5の開弁圧力より低く設定しているので、遮断弁4を閉じる所定の圧力を安全弁5の開弁圧力よりも高く設定した場合に検知できなかった微少な圧力変動が発生する場合でも減圧器3の不良を検知することができる。また、安全弁を開放することによる、必要以上の燃料ガスの放出をさけることができる。

**【0022】**

図3は、本発明の一実施形態に係る圧力センサ6の指示値を示したグラフ（タイムチャート）である。（a）は減圧器3が回復した場合の圧力センサ6の指示値を示すグラフであり、（b）は減圧器3が回復していない場合の圧力センサ6の指示値を示すグラフである。

**【0023】**

図3（a）において、減圧器3の機能の不具合などにより、減圧室側の圧力が所定の圧力を超え、燃料ガスの供給が止まってガス燃料機器（燃料電池）7が停止した場合に、再起動する様子を圧力の推移で示している。縦軸が圧力センサ6の指示値を示し、横軸は時間軸を示している。通常、減圧器3の減圧室側3aの圧力は、通常圧力aを示している（時間軸上の指示値A）。減圧器3に不具合が発生すると圧力センサ6の指示値が上昇し、不良検知の閾値bを示す、ここで減圧器3の上流の遮断弁2および下流の遮断弁4を閉じて（時間軸上の指示値B）、燃料ガスの供給を停止する。その後、圧力センサの指示値は多少上昇するものの、図3（a）の時間軸上の指示値Bと時間軸上の指示値Cとの間のグラフに示すように、ある圧力で推移する。燃料ガスの供給を停止した後の圧力上昇によって安全弁が作動した場合は、その作動圧力未満になるまで、燃料ガスを放出し、ある圧力で推移する。

**【0024】**

ガス燃料供給装置100が圧力の異常で停止した後、再起動をする際に、減圧器3の下流の遮断弁4を開放すると（時間軸上の指示値C）、圧力センサ6の指示値は下がり、不良検知の閾値bを通過する。ここで、上流の遮断弁2を開くと（時間軸上の指示値D）、圧力センサ6の指示値は通常圧力aに達し、ガス燃料機器7に燃料が供給されて再起動される。尚、遮断弁2、4を遮断するときの閾値b（所定の圧力）と、遮断弁2を開くときの閾値b（所定の圧力）を異なるものとして、ヒステリシスを設定するようにしてもよい。

**【0025】**

図3（b）は減圧器3の機能に不具合が発生し、燃料ガスの供給が止まってガス燃料機器

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7が停止した後の再起動時に減圧弁の不具合が解消しておらず、再びガス燃料機器7が停止する様子をグラフで示している。このグラフの圧力の推移は、図3(a)における時間軸上の指示値D迄は同様であり、減圧器3の上流の遮断弁2を開くと(時間軸上の指示値D)、圧力センサ6の指示値は、一旦、下がるが減圧器3の不具合が解消されていない場合、減圧室側3aの圧力が減圧されないため、すぐに上昇し始め、減圧器3の減圧室側3aの圧力の不具合を検知する不良検知の閾値bを超える。そのため、圧力センサ6の指示により遮断弁2、4が閉じ(時間軸上の指示値E)、燃料ガスの供給を停止する。このように圧力の異常で停止した減圧器3が、ガス燃料機器の再起動時に回復していなかつたとき、圧力センサ6が減圧器3の不良を検知すると共に、安全弁5が作動している。尚、前記減圧器3と前記下流側遮断弁4との間の圧力は、減圧室内の圧力を含んで意味するものである。

#### 【0026】

そのため、本実施の形態によれば、減圧器3の減圧室側3aの圧力を検知する圧力センサ6と、減圧器3の上流および下流に遮断弁2、4を持ち、減圧器3の減圧室の圧力が所定の圧力以上になると2つの遮断弁2、4を同時に遮断し、ガス燃料機器7の再起動の際は、減圧器3の下流の遮断弁4を先に開き、減圧室側3aの圧力が所定の圧力未満となったとき、減圧器3の上流の遮断弁2を開くことにより、ガス燃料機器7の再起動が可能となり、前記した問題が解決される。また、本発明により減圧器3の減圧室側3aに安全弁5を設けた場合においても、遮断弁2、4を閉じる所定の圧力の設定にかかわらず、ガス燃料機器7の再起動が可能となる。また、遮断弁2、4を閉じる所定の圧力を安全弁5の開弁圧力よりも低く設定することで、遮断弁2、4を閉じる所定の圧力を安全弁5の開弁圧力よりも高く設定した場合に検知できなかつた微少な圧力の変動が発生するケースでも、減圧器3の不良を検知することができる。

#### 【0027】

以上述べた実施の形態は本発明を説明するための一例であり、本発明は、前記の実施の形態に限定されるものではなく、発明の要旨の範囲内で種々の変更が可能である。たとえば、本実施の形態において、ガス燃料機器は、自動車に積載して使用するものに関して説明したが、船舶や航空機などに適用することもできる。また、地上設置型(定置型)のガス燃料機器にも適用することもできる。

#### 【0028】

##### 【発明の効果】

以上説明したように、請求項1に記載の発明によれば、減圧器の下流側の圧力が所定の圧力以上になると減圧器を不良として検知し、燃料ガスを減圧する減圧器の上流および下流に設けられた2つの遮断弁を同時に遮断するため、減圧器の下流の遮断弁と接続されているガス燃料機器を安全に停止することができる。

#### 【0029】

また、内燃機関もしくは燃料電池などのガス燃料機器の再起動時には、減圧器の下流の遮断弁を先に開き、ガス燃料機器へ燃料ガスの供給を開始し、減圧器の下流側の圧力が所定の圧力未満となったとき、減圧器の上流の遮断弁を後に開くため、圧力センサは減圧室側の圧力が所定の圧力未満であることを確認し、ガス燃料機器を容易に再起動することができる。さらに、減圧器の不具合が解消した場合にはガス燃料機器の運転を再開することができる。

#### 【0030】

請求項2に記載の発明によれば、減圧器の圧力が異常となって停止した後、減圧器の機能が回復した場合、ガス燃料機器を容易に再起動することができる。

##### 【図面の簡単な説明】

【図1】本発明の一実施形態に係るガス燃料供給装置の構成を示す概略図である。

【図2】本発明の一実施形態に係るガス燃料供給装置の動作を示すフローチャートである

【図3】本発明の一実施形態に係る圧力センサの指示値を示すグラフであり、(a)は減

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・ 壓器が回復した場合を示し、(b)は減圧器が回復していない場合を示す。

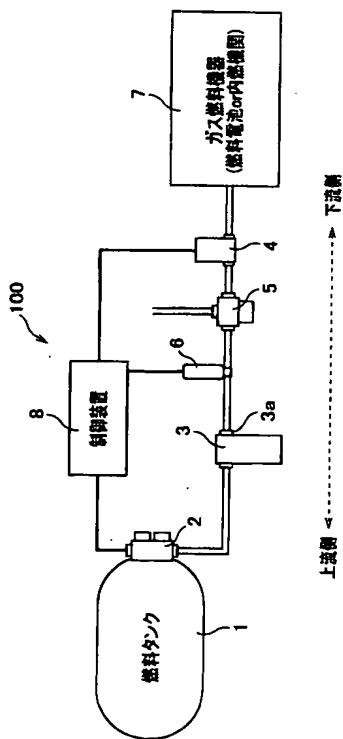
【符号の説明】

- 1 燃料タンク
- 2、4 遮断弁
- 3 減圧器
- 3a 減圧室側
- 5 安全弁
- 6 圧力センサ
- 7 ガス燃料機器  
(ガス電気の内燃機関)
- 8 制御装置

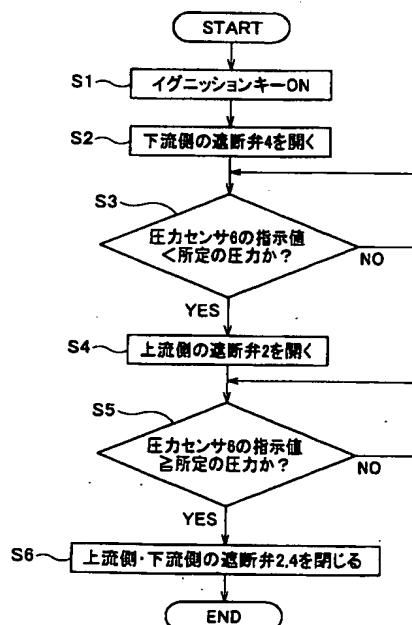
100 ガス燃料供給装置

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【図1】



【図2】



【図3】

